

XV. *An Account of Ambergrise, by Dr. Schwediawer ;
presented by Sir Joseph Banks, P. R. S.*

Read February 13, 1783.

AMBERGRISE, or properly speaking *Grey Amber*, is a solid, opaque, inflammable substance, of a white grey, sometimes of a blackish colour, which melted or inflamed yields a peculiar smell, agreeable to most persons, but disagreeable to others.

As it occurs in the shops, it varies in its consistence, according as it has been exposed to a warmer or colder air. It is a hard brittle substance, yet not so hard as to admit a polish; nor has it, like succinum, a polished appearance or transparency. On scraping it with a knife into powder, part of it adheres to the cold steel like wax; so it does also to the teeth, if masticated; it yields also the impression of the nail; it has no peculiar but rather an earthy taste when chewed.

It has in its natural state a peculiar strong smell. The older it grows the more it seems to become agreeable. This smell is rendered more sensible by rubbing it with the fingers, or by burning or melting it.

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It melts in a moderate degree of heat into a blackish thick oil, and then smoaks, skums, and flies by degrees entirely off, without leaving any coal behind; so it does likewise when put upon any heated metal, leaving only a black spot upon it: when the metal is red-hot, it melts and inflames instantaneously, smoaks strongly, and flies speedily off, without leaving the least mark behind. When brought near a burning candle, it catches fire immediately, and burns with a clear bright flame till it is consumed. A red-hot needle easily penetrates through its substance, a blackish oil then exfudes, but no part of it seems to adhere to the needle; the needle, however, feels afterwards as if it had been put into wax.

It is so light, that it swims not only upon the sea, but also on the surface of fresh water.

Its colour is white grey, or yellowish, or blackish, the first of which is esteemed the best. All ambergrise, when kept for a certain time, is covered with a kind of white grey dust like chocolate. When broken it appears to be of a granulated texture; and in some pieces it seems to be laid on in strata.

It feels rather rough when first touched, but, when rubbed with the finger, it feels like hard soap, or rather like that kind of stone which the mineralogists call *Smeétis*.

It is found swimming upon the sea, or the sea-coast, or in the sand near the sea-coast; especially in the Atlantic Ocean, on the sea-coast of Brasil, and that of Madagascar; on the coast of Africa, of the East Indies, China, Japan, and the Molucca Islands; but most of the ambergrise which is brought to England comes from the Bahama Islands, from Providence, &c. where it is found on the coast. It is also sometimes found in the abdomen of whales by the whale-fishermen, always in lumps of various shapes and sizes, weighing from half an ounce to an hundred

and more pounds. The piece, which the Dutch East India Company bought from the King of Tydor, weighed 182 pounds. An American fisherman from Antigua found some years ago, about 52 leagues south-east from the Windward Islands, a piece of ambergrise in a whale, which weighed about 130 pounds, and sold for five hundred pounds sterling.

We are told by all writers on ambergrise, that sometimes claws and beaks of birds, feathers of birds, parts of vegetables, shells, fish, and bones of fish, are found in the middle of it, or variously mixed with it; but of a very large quantity of pieces which I have seen, and which I have carefully examined, I have found none that contained any such thing, though I do not deny, that such substances may sometimes be found in it; but the circumstance which to me seems to be the most remarkable, is, that in all the pieces of ambergrise of any considerable size, whether found on the sea, or in the whale, which I have seen, I have constantly found a considerable quantity of black spots, which, after the most careful examination, appear to be the beaks of the *Sepia Octopodia*. These beaks seem to be the substances which have hitherto been always mistaken for claws or beaks of birds, or for shells.

Having collected a pretty large quantity of them, I beg leave to present to the Royal Society some specimens, in which the whole structure of these beaks is extremely well preserved. They are accompanied by a beak which Sir JOSEPH BANKS permitted me to take from a cuttle fish in his collection, so that any gentleman, who will be at the pains to compare them together, will be enabled to convince himself of the truth of what I have advanced.

The presence of these beaks in ambergrise proves evidently, that all ambergrise containing them is in its origin, or must have

have been once, of a very soft or liquid nature, as otherwise those beaks could not so constantly be intermixed with it throughout its whole substance.

In order to come now more closely to the point proposed (*viz.* to determine the origin and nature of ambergrise), let us recollect some of the principal facts relative to its natural history.

That ambergrise is found either upon the sea and sea-coast, or in the bowels of whales, is a matter of fact, which, I believe, is universally credited. But it has never been examined into and determined, whether the ambergrise found upon the sea and sea-coast is the same as that found in the whale, or whether they are different from one another? Whether that found on the sea or sea-coast has some properties, or constituent parts, which that found in the whale has not? And lastly, Whether that found in the whale is superior or inferior in its qualities and value to the former?

It is likewise a matter of consequence to know, Whether ambergrise is found in all kinds of whales, or only in a particular species of them? Whether it is constantly and always to be met with in those animals? And, if so, in what part of their body it is to be found?

It is further a matter of enquiry, Whether, on those coasts where ambergrise is found, there are also constantly, or only accidentally, whales to be met with? Whether ambergrise is found there because whales frequent those seas, or rather whether whales are there because ambergrise is to be met with there?

It ought likewise to be investigated, Whether all ambergrise is of the same mineral or animal origin? If of the former, whether it is swallowed by the whale, and digested or changed in some manner in its stomach? Or, if of the latter, whether it

it is an animal production generated in the stomach as a kind of bezoar, according to CLUSIUS; or secreted in a peculiar bag, according to DUDLEY, &c.? Or lastly, Whether it is, according to KÆMPFER, the excrement or dung of the whale?

All these questions ought to be discussed and precisely answered, before we can determine any thing with certainty about the origin of ambergrise.

In order to clear up this point, we must apply to the persons who are employed in procuring and selling ambergrise. This is what I have had an opportunity of doing through the kindness of Sir JOSEPH BANKS, baronet, whose zeal to promote every part of useful knowledge is so generally known and acknowledged by the public. Sir JOSEPH very obligingly procured me the acquaintance of two captains of ships, men of good sense and veracity, who offered to tell me every thing they knew about the matter, and who began with assuring me that they would speak only as to what they themselves had seen, and that not once only, but repeatedly, as they have both of them been employed many years in what is called in England the South Fishery. I have since had an opportunity of conversing on the same subject with an intelligent native of New England, who before the present war broke out was employed for several years in the spermaceti-whale fishery from Boston. From these three persons I have collected the following facts:

Ambergrise is sometimes found in the belly of the whale, but in that particular species only which is called the spermaceti whale, and which from its description and delineation appears to be the *Phyfeter Macrocephalus* Linnæi.

The New England fishermen, according to their account, have long known that ambergrise is to be found in the spermaceti whale; and they are so convinced of this fact, that when-

ever

ever they hear of a place where ambergrise is found, they always conclude that the seas in that part are frequented by this species of whale. It was for this reason that a gentleman at Boston, upon hearing several years ago that ambergrise was frequently found on the coast of Madagascar, immediately proposed a plan for a spermaceti-whale fishery in that part of the world. And the two persons I conversed with on this subject have not the least doubt but he would have succeeded in the attempt, had not the East India Company frustrated the project, by pretending, that as it was in their territory the right of fishery could belong only to them. This was all they did, however, as the plan itself they never adopted.

The persons who are employed in the spermaceti-whale fishery, confine their views to the *Physeter Macrocephalus*. They look for ambergrise in all the spermaceti-whales they catch, but it seldom happens that they find any. Whenever they hook a spermaceti-whale, they observe, that it constantly not only vomits up whatever it has in its stomach, but also generally discharges its fæces at the same time; and if this latter circumstance takes place, they are generally disappointed in finding ambergrise in its belly. But whenever they discover a spermaceti-whale, male or female, which seems torpid and sickly, they are always pretty sure to find ambergrise, as the whale in this state seldom voids its fæces upon being hooked. They likewise generally meet with it in the dead spermaceti-whales which they sometimes find floating on the sea. It is observed also, that the whale, in which they find ambergrise, often has a morbid protuberance; or, as they express it, a kind of gathering in the lower part of its belly, in which, if cut open, ambergrise is found. It is observed, that all these whales, in whose bowels am-

bergrise

bergrife is found, seem not only torpid and sick, but are also constantly leaner than others; so that, if we may judge from the constant union of these two circumstances, it would seem that a larger collection of ambergrife in the belly of the whale is a source of disease, and probably sometimes the cause of its death. As soon as they hook a whale of this description, torpid, sickly, emaciated, or one that does not dung on being hooked, they immediately either cut up the above-mentioned protuberance, if there be any, or they rip open its bowels from the orifice of the anus, and find the ambergrife, sometimes in one sometimes in different lumps of generally from three to twelve and more inches in diameter, and from one pound to twenty or thirty pounds in weight, at the distance of two, but most frequently of about six or seven feet from the anus, and never higher up in the intestinal canal, which, according to their description, is, in all probability, the intestinum cœcum, hitherto mistaken for a peculiar bag made by nature for the secretion and collection of this singular substance. That the part they cut open to come at the ambergrife is no other than the intestinal canal is certain, because they constantly begin their incision at the anus, and find the cavity every where filled with the fæces of the whale, which from their colour and smell it is impossible for them to mistake. The ambergrife found in the intestinal canal is not so hard as that which is found on the sea or sea-coast, but soon grows hard in the air: when first taken out it has nearly the same colour, and the same disagreeable smell, though not so strong, as the more liquid dung of the whale has; but, on exposing it to the air, it by degrees not only grows greyish, and its surface is covered with a greyish dust like old chocolate, but it also loses its disagreeable smell, and, when kept for a certain length of time, acquires the peculiar odour which is so agreeable to most people.

The gentlemen I conversed with confessed, that if they knew not from experience that ambergrife thus found will in time acquire the above-mentioned qualities, they would by no means be able to distinguish ambergrife from hard indurated fæces. This is so true, that whenever a whale voids its fæces upon being hooked, they look carefully to see if they cannot discover among the more liquid excrements (of which the whale discharges several barrels) some pieces floating on the sea, of a more compact substance than the rest; these they take up and wash, knowing them to be ambergrife.

From this account it appears therefore clearly, that CLUSIUS is quite wrong in asserting that ambergrife is a phlegmatic recrement, or indurated undigestible part of the food collected and found in the stomach of the whale, in the same manner as the bezoars are found in the stomach of other animals. It appears further, that what DUDLEY says, in *Phil. Trans.* vol. XXIII. from an account he received from a whale-fisherman, one Mr. ATKINS, of Boston in New England, who was one of the first who went out a fishing for the spermaceti-whale about the year 1720, viz. that the ambergrife found in whales is a kind of animal production like musk and castoreum, &c. secreted and collected in a peculiar bag or bladder, which is furnished with an excretory duct or canal, the spout of which runs tapering into and through the length of the penis; and that this bag, which lies just over the testicles, is almost full of a deep orange-coloured liquor, not quite so thick as oil, of the same smell as the balls of ambergrife, which float and swim loose in it; which colour and liquor may also be found in the canal of the penis; and that therefore ambergrife is never to be found in any female, but in the male only, is equally destitute of truth. The asser-

tions are not only destitute of truth, but also contrary to the laws of the animal œconomy ; for, in the first place, the gentlemen whom I consulted have repeatedly found ambergrise in males as well as females ; they think, however, to have remarked, that the ambergrise found in females is never in such large pieces, or of so good a quality, as that which is found in males. 2dly, No man, who has the least knowledge in anatomy and the animal œconomy, will ever believe that organised bodies, such as the beaks of the Sepia, which are so constantly found in ambergrise taken out of the whale, can have been absorbed from the intestines by the lacteals or lymphatics, and collected with the ambergrise in the bag mentioned by ATKINS and DUDLEY. If either of those persons had known the nature of these substances, and had had the least knowledge of the different secretions in animal bodies, they would certainly never have ventured to give such a description as a true one.

KÆMPFER, who has given us so many other faithful accounts in Natural History, seems to come nearer the truth with regard to the origin of ambergrise, when he says, that it is the dung of the whale ; and that the Japanese, for this reason, call it, Kufura no fuu, *i. e.* Whale's Dung ; but this relation, though founded on observation, has never obtained credit, and has been considered rather as a fabulous story, with which the Japanese imposed upon him, who had himself no direct observation to prove the fact.

This matter therefore remained a subject of great doubt, and it was generally thought to be more probable, that ambergrise, after having been swallowed, and somehow or other changed in the stomach and bowels of the whale, was found among its excrements. But in order to discuss this matter fully, and bring

bring it nearer to that degree of certainty which I proposed at the beginning of this paper, it will now be proper to examine the principal question, Whether all ambergrise is generated in the bowels of the whale, or whether it is simply an extraneous substance taken in with the food? In order to elucidate this matter, it will be necessary to resolve the following questions:

1st. Whether there is any material difference between ambergrise found upon the sea or sea-coast, and that found in the bowels or among the dung of the whale, either with regard to its qualities and chemical principles, or with respect to the heterogeneous substances that are mixed with it? And 2dly, If there is any such difference, in what does it consist?

From the most exact information I have been able to procure on this subject, I find that what several authors have asserted, that all ambergrise found in whales is of an inferior quality, and therefore much less in price, is destitute of truth. Ambergrise is only valued for its purity, lightness, compactness, colour, and smell. There are pieces of ambergrise found on different coasts, which are of a very inferior quality, whereas there are often found pieces of it in whales of the first value; nay, several pieces found in the same whale, according to the above-mentioned qualities, are more or less valuable. All ambergrise found in whales has at first when taken out of the intestines very near the same smell as the liquid excrements of that animal have; it has then also nearly the same blackish colour: they find it in the whale sometimes quite hard, sometimes rather softish, but never so liquid as the natural fæces of that animal. And it is a matter of fact, that, after being taken out and kept in the air, all ambergrise grows not only harder and whiter, but also loses by degrees its smell, and assumes such an agreeable one, as that in general has which is found

swimming upon the sea; therefore the goodness of ambergrise seems rather to depend on its age. By being accumulated after a certain length of time in the intestinal canal, it seems even then to become of a whiter colour, and less ponderous, and acquire its agreeable smell. The only reason why ambergrise found floating on the sea generally possesses the above-mentioned qualities in a superior degree, is because it is commonly older, and has been longer exposed to the air. It is more frequently found in males than females; the pieces found in females are in general smaller, and those found in males seem constantly to be larger and of a better quality, and therefore the high price in proportion to the size is not merely imaginary for the rarity-sake, but in some respect well founded, because such large pieces appear to be of a greater age, and possess the above-mentioned qualities in general in a higher degree of perfection than smaller pieces.

Having discovered, as I just now mentioned, beaks of the cuttle fish in all the pieces of ambergrise I had an opportunity of examining, it now remained to be ascertained, how those beaks became so constantly mixed with ambergrise? In prosecuting this enquiry, I had the satisfaction to learn from the same persons who gave me the information above-mentioned, that the *Sepia Octopodia*, or cuttle fish, is the constant and natural food of the spermaceti-whale, or *Phyfeter Macrocephalus*. Of this they are so well persuaded, that whenever they discover any recent relics of it swimming on the sea, they conclude that a whale of this kind is, or has been, in that part. Another circumstance which corroborates this fact is, that the spermaceti-whale on being hooked generally vomits up some remains of the *Sepia* *.

From

* It will not be improper here to remark, to what an enormous size this species of *Sepia* grows in the ocean. One of the gentlemen who was so kind as to communicate

From what I have faid, we may easily account for the many beaks, or pieces of beaks, of the *Sepia* found in all *ambergrife*.

The beak of the *Sepia* is a black horny fubftance, and therefore paffes undigefted through the ftomach into the intefstinal canal, where it is mixed with the fæces; after which it is either evacuated with them, or if thefe latter be preternaturally retained, forms concretions with them, which render the animal fick and torpid, and produce an obftipation, which ends either in an abfcefs of the abdomen, as has been frequently obferved, or becomes fatal to the animal; whence in both the cafes, on the burfting of its belly, that hardened fubftance, known under the name of *ambergrife*, is found fwimming on the fea, or thrown upon the coaft.

From the preceding account, and my having constantly found the above-mentioned beaks of the *Sepia* in all pieces of *ambergrife* of any confiderable fize, I think we may venture to conclude, that all *ambergrife* is generated in the bowels of the *Phyfeter Macrocephalus*, or *fpermaceti-whale*, and there mixed with the beaks of the *Sepia Octopodia*, which is the principal food of that whale; and we may therefore define *ambergrife* to be the preternaturally hardened dung or fæces of the *Phyfeter*

municate to me his obfervations on this fubject, about ten years ago hooked a *fpermaceti-whale* that had in its mouth a large fubftance with which he was unacquainted, but which proved to be a *dentaculum* of the *Sepia Octopodia*, nearly 27 feet long: this *dentaculum* however did not feem to be entire, one end of it appearing in fome meafure corroded by digefion, fo that in its natural ftate it may have been a great deal longer. With regard to its being a *dentaculum* of the cuttle fifh, the fifhermen could not have been miftaken, as they themfelves often feed upon the fmaller fort of the fame *Sepia*. When we confider the enormous bulk of the *dentaculum* of the *Sepia* here fpoken of, we fhall ceafe to wonder at the common faying of the fifhermen, that the cuttle-fifh is the largeft fifh of the ocean.

Macrocephalus,

Macrocephalus, mixed with some indigestible relics of its food.

There now remains only one objection to be obviated on this subject, and this relates to the chemical analysis of ambergrise*.

NEUMANN obtained from one drachm of ambergrise five grains of an acid phlegm, two scruples and an half of empyreumatic oil, and two grains of a volatile acid salt in a crystalline form.

Now if all ambergrise owes its origin to the animal kingdom in the manner we have stated, how are we to account for the acid obtained from it by distillation? Would not ambergrise, if it was really of an animal nature, like all other fæces of animals feeding upon animal food, yield a volatile alkali? I confess this seems to be a material objection; but I reply to it, first, that although my experiments made upon unadulterated ambergrise confirm those made by NEUMANN, GRIM, BROWNE, and GEOFFROY; yet from that analysis it does, in my opinion, by no means follow, that ambergrise is not an animal product.

Two eminent chemists, Mr. SCHEELE, and my friend Mr. BERGMAN, professor of chemistry at Upsal, have lately discovered that human calculi of the bladder, though of an animal origin, are nothing else but a peculiar concrete acid, approaching in its qualities very nearly to the native vegetable acid: and Professor CRELL has lately shewn, in a paper presented to the Royal Society, that the presence of an acid, far from proving any thing against an animal substance, is to be found in the fat

* Chemistry shews that in all animal excrements an acid is present, though different from that found in ambergrise. Besides, we do not know whether the marine acid of the sea-water in which these animals constantly live, has not a share in changing the nature of their fæces; nor whether the fæces of all cetaceous animals are perhaps by their chemical analysis not materially different from those of animals living on the Continent. We have a chemical analysis of these latter, but none has been hitherto made of the former.

of all animals. This indeed proves as little as if I should conclude on the opposite side of the question, that because the cruciform plants yield first a volatile alkali in distillation, they are of an animal nature. This, however, I have by repeated experiments with *Cochlaria*, *Nasturtium*, &c. seen to be constantly the case. With regard to the nature of the acid which is obtained by distillation from ambergrise, nobody has hitherto to my knowledge examined it; and the experiments I made upon it are insufficient to say any thing positive about it.

The great price of ambergrise (an ounce of it being now sold in London for one pound sterling) has been hitherto the cause of its being so often adulterated, and of its being so little examined by chemists. If, however, a chemical analysis of its acid should be made, we ought to be certain that the ambergrise employed has not been previously adulterated, especially as it is but too common to find it adulterated with flower of rice, or with styrax or other resins, which might deceive us in forming a solid judgement about the real nature of its acid. The adulteration of ambergrise with any of the heterogenous substances may be discovered by its not having all the qualities mentioned above as requisite for the purest and best ambergrise.

The use of ambergrise in Europe is now nearly confined to perfumery, though it has formerly been recommended in physic by several eminent physicians; hence the *Essentia Ambraë Hoffmanni*, *Tinctura Regia Cod. Parisini*, *Trochisci de Ambra Ph. Wurtemberg*, &c. &c.

If we wish to see any medicinal effects from this substance, we must certainly not expect them from two or three grains, but give rather as many scruples of it for a dose; though even then I should not expect much effect from it, as I have taken of pure unadulterated ambergrise in powder 30 grains at once, without

without observing the least sensible effect from it. A sailor, however, who had the curiosity to try the effect of recent ambergrise upon himself, took half an ounce of it melted upon the fire, and found it a good purgative; which proves, that it is not quite an inert substance.

In Asia and part of Africa ambergrise is not only used as a medicine and as a perfume, but a great use is also made of it in cookery, by adding it to several dishes as a spice; a great quantity of it is also constantly bought by the Pilgrims who travel to Mecca, probably to offer it there, and make use of it in fumigations, in the same manner as frankincense is used in Catholic countries. The Turks make use of it as an aphrodisiac. Our perfumers add it to scented pillars, candles, balls or bottles, gloves, and hair-powder; and its essence is mixed with pomatums for the face and hands, either alone or mixed with musk, &c. though its smell is to some persons extremely offensive.

Having now finished my remarks about ambergrise, I shall conclude this paper with some new observations concerning the sebaceous substance generally called Spermaceti, and the whale from which it is obtained.

I mentioned above that it is only one kind of whale from which our fishermen obtain the spermaceti, which they call for this reason the Spermaceti Whale: in this same fish it is that they find ambergrise. They never search after the *Phyfeter Catodon*, the *Phyfeter Microps*, *Phyfeter Turfio*, and others of the same genus; but they aim at taking both the male and female of the *Phyfeter Macrocephalus*, though the male contains not only a larger quantity, but also in their opinion a better quality of spermaceti.

1st. It is to be observed, that this species has but one spout (*fistula*). This spout is not, as hath been generally hitherto asserted, in the neck (*cervix*) of the fish, but in its front, and on the very edge of the head, bending obliquely on the left side, so that whenever he spouts it is always on that side only.

2dly. It is also remarkable, that the female of this whale has a power of drawing back its breasts after it has suckled the calf, so that it hardly appears to have any prominence on the belly, whereas when it suckles they hang out very long.

3dly. It is not true, though it has hitherto been asserted, that the substance which we so absurdly name *Spermaceti*, and which perhaps might with much greater propriety be called *Sevum Physeteris*, is found in the ventricles of the brain, and in the cavity of the spinal marrow of the *Physeter Macrocephalus*. This fat substance, which is nothing but a kind of fuet, undoubtedly formed for some particular purpose of that whale, is contained in a peculiar bony triangular cavity or trunk, which is lodged near the brain, and occupies nearly the whole upper part of the head. This trunk has no communication with the brain, but is entirely separated from it by its bony laminae. The brain, as in all other fishes, is very small in comparison with the size of the whale, and lies directly behind the eyes.

In order to know whether the trunk in which the spermaceti is lodged had any connection with the brain of the whale, one of the above-mentioned gentlemen had the curiosity to lance that trunk, which in its upper part is only covered with the skin, he found the whale not in the least affected by this, but on the brain being lanced, the same whale died immediately.

